Numerical Modeling of 2-D Diffusion-Advection-Reaction Flows in Marine Sediments BORIS CHERNYAVSKY, THOMAS ECKERT, ULRICH WORTMANN, Geobiology Stable Isotope Laboratory, Geology Department, University of Toronto — We develop and investigate a 2-D numerical simulation for diffusion-advection-reaction processes in marine sediments. The simulation program is written in open source Octave language using a semi-implicit numerical scheme for both unsteady and steady state cases. We analyze and compare the accuracy, performance and stability trade-offs of several numerical schemes. We also test the influence of temporal resolution and time variability. We test our numerical results against several known experimental data sets, including cases of total sulfate consumption and brine incursion. To validate the physical correctness of the obtained solution, we apply our program to simulations of marine pore water profiles [from Ocean Drilling Program Leg 182 in the Great Australian Bight] with focus on bacterial sulfate reduction. We compare the results of the 2-D simulation versus a 1-D and partial 2-D model. We demonstrate that full 2-D model accounting for the lateral flow intrusion into the sediment is required to correctly model the physics of the process.

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